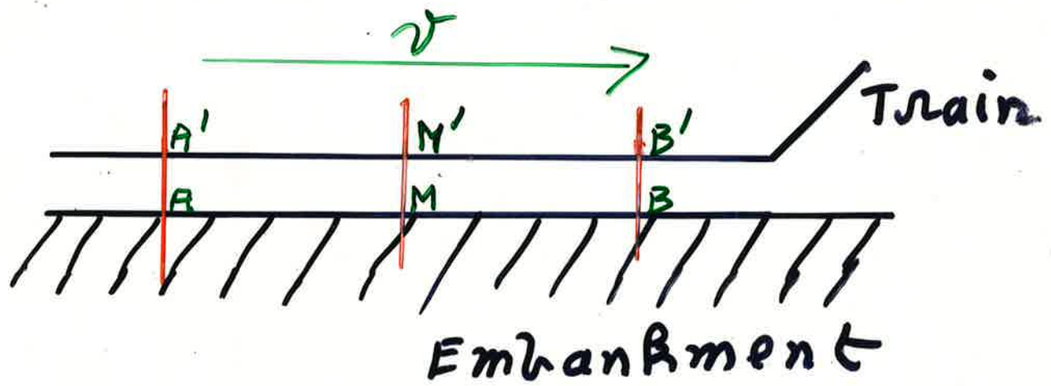
EINSTEIN'S TRAIN



RELATIVITY

We Cannot detect motion relative to absolute space and time, but only motion relative to some reference system ('observer') specified by material objects such as rods and clocks.

Aristotle - No Relativity.

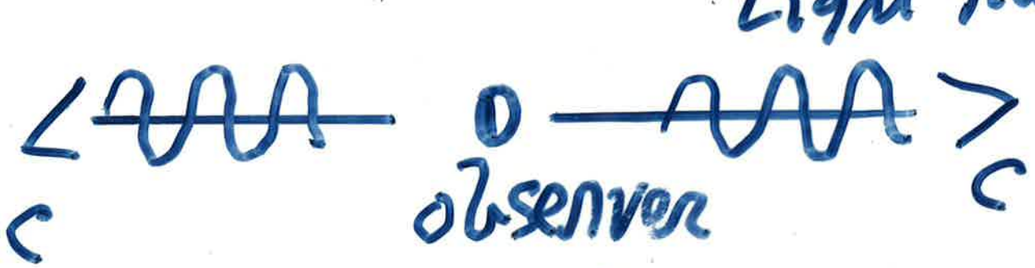
We can establish

Absolute Position
" velocity
" acceleration

Galilean Relativity

We cannot detect absolute position or velocity. But we can detect absolute acceleration.

Galilean Relativity is true & Newtonian Mechanics but breaks down for Optical effects.



Apparent velocity of light = c − v to right
= c + v to left

But measurement shows
that velocity of light relative
to the observer remains
the <u>same</u> in all directions

(Michelson - Morley Experiment)

How to reconcile Galilean
relativity and Electromagnetism?
change e-m theory <u>or</u> space/time notions

↑
Einstein (1905)

e-m now satisfies special Relativity Principle (S.R.)

But Mechanics does not

So Einstein now changed Mechanics so as to conform to S.R.

e.g. Mass depends on velocity

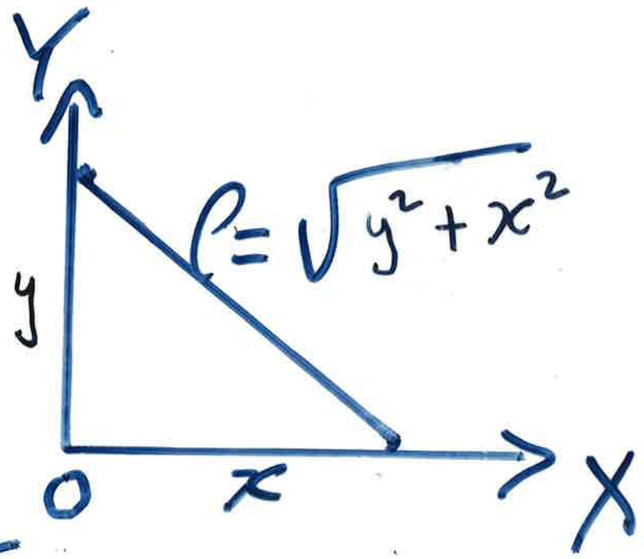
$E = mc^2$

2 Sorts of Relation

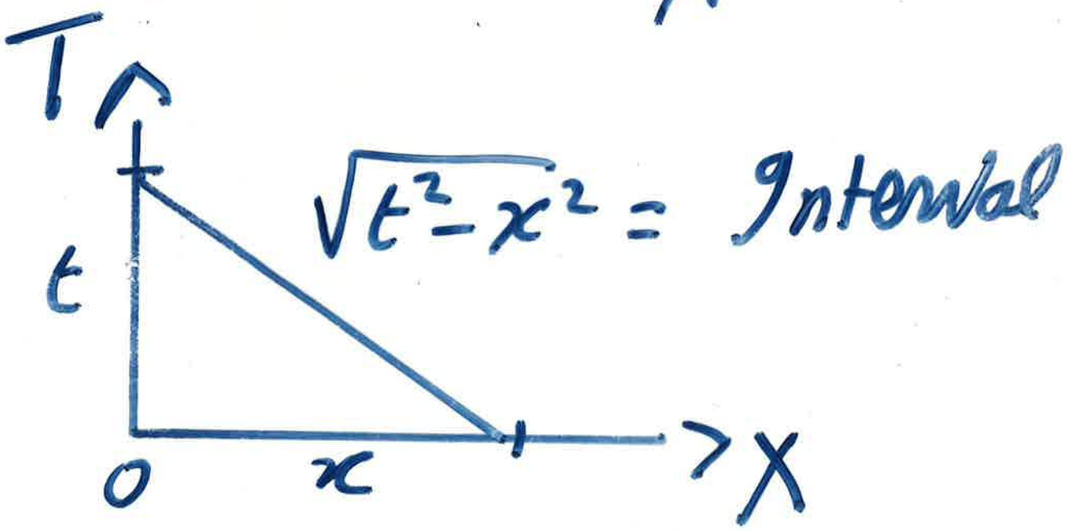
	Absolute	Relative (to observer)
C.M.	Length duration simultaneity	velocity
S.R.	velocity of Light Interval in space/time	Length duration Simultaneity

Compare

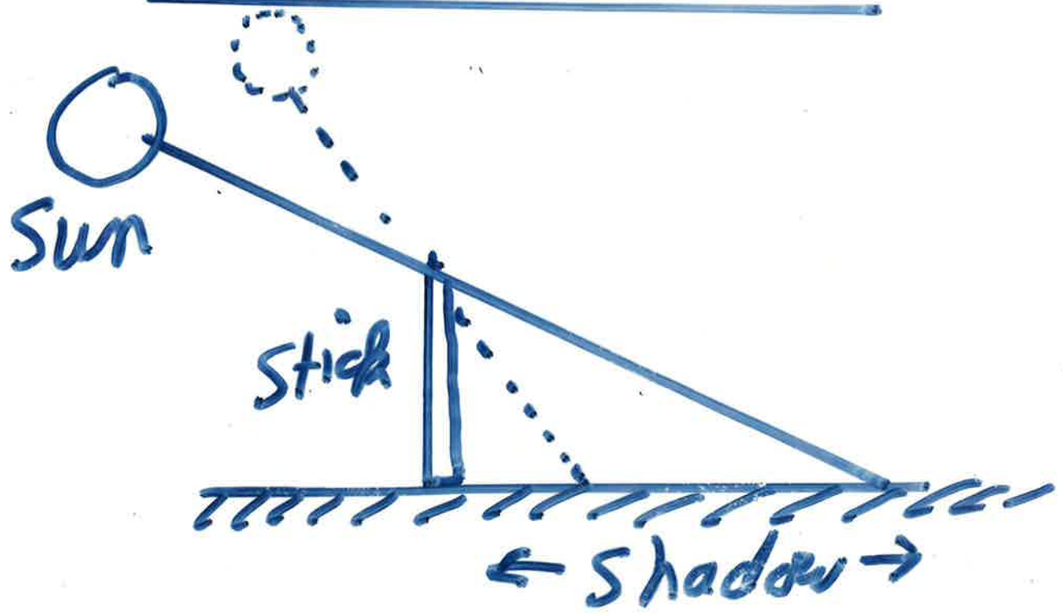
Euclidean geometry of Space



Non-Euclidean Geometry of space-time



Absolute Relations are Real.



General Relativity

1.) We cannot detect absolute acceleration

2.) acceleration = Gravitation

3.) Gravitation = 'curvature' of space-time.

Particle follows the 'groove' of the curvature
- replaces Newton's concept of Gravitational force.

If this formulation of G.R. were true

$\Rightarrow$ Relativism (?)

But it is <u>not</u> true(!)

S-T acts on Matter
(via curvature)

Matter acts on S-T
(producing curvature)

So we have a
<u>Relatedness</u>
of S-T and Matter.

But S-T is not reduced to matter in G.R.

Indeed there is one version of G.R. (geometrodynamics) in which matter is reduced to S-T